CLAIMS:

1. Multirate filter having

- an input unit for receiving an input signal and for providing a plurality of intermediate signals in response to said input signal,
- a filter unit coupled to the input unit,
- an output unit coupled to the filter unit, for generating an output signal,

the filter unit comprising at least a first and a second filter module, having a transfer function $H_0(z)$ and a transfer function $H_1(z)$ respectively, which are mutually related according to the relations

$H_0(z) = c_0(H_B(z) + \mathrm{M}_{\alpha,\psi} H_B(z))$ and

$H_1(z) = c_1(H_B(z) - \mathrm{M}_{\alpha,\psi} H_B(z))$, wherein

$\mathrm{M}_{\alpha,\psi}(H_B(z)) = \alpha z^{-2\psi} \tilde{H}_B^*(z^{-1})$, and wherein

$\tilde{H}_B^*(z) = \sum h_b^*[m] z^{-m}$, $H_B(z)$ being the z-transform of $h_b[m]$

the multirate filter comprising a combination unit coupled to said filter modules for generating a first combination signal and a second combination signal.

2. Multirate filter according to claim 1, wherein

$H_B(z) = H_{R:r}(z) = \sum_n h[Rn + r] z^{-n}$, wherein

$H(z)$ is the z-transform of h[n].

3. Multirate filter according to claim 2, wherein the combination unit is comprised in the input unit, and generates the first and the second combination signal from a pair of the said intermediate signals and that the first filter module filters the first combination signal and the second filter module filters the second combination signal.

4. Multirate filter according to claim 2, wherein the first and the second filter module each filter a respective one of the said intermediate signals and that the combination

unit is comprised in the output unit and generates the first combination signal and the second combination signal from output signals of the first and the second filter module.

5. Multirate filter according to claim 1, wherein

$H_B(z) = H_{R:r_0}(z) + z^b H_{R:r_1}(z)$ and

wherein the combination unit is comprised in the input unit, and generates the first and the second combination signal from a pair of the said intermediate signals and that the first filter module filters the first combination signal and the second filter module filters the second combination signal, wherein the filter unit comprises a third filter module with a transfer function $H_2(z)$ and a fourth filter module with a transfer function $H_3(z)$ which are mutually related according to the relations

$H_2(z) = c_2(H'_B(z) - \mathrm{M}_{\alpha,\psi} H'_B(z))$

$H_3(z) = c_3(H'_B(z) + \mathrm{M}_{\alpha,\psi} H'_B(z))$, wherein

$H'_B(z) = H_{R:r_0}(z) - z^b H_{R:r_1}(z)$

which third and fourth filter module each filter a respective one of the first combination signal and the second combination signal, the filter comprising a first further combination unit for generating a first auxiliary signal and a second auxiliary signal in response to the output signals of the third filter module and the fourth filter module, the filter comprising a second further combination unit for generating a first and a second further combination signal from the first and the second auxiliary signal.

6. Image processing device comprising an input for receiving image data, a multirate filter according to one of the previous claims, a controller for controlling the filter, a memory for storing data to be used by the configurable filter, and an output for providing output data to a display device.

7. Mobile telephone comprising

- a receiver for receiving an information signal from an antenna,
- an analog-to-digital converter for converting the information signal to discrete samples
- a multirate filter according to one of the claims 1 to 5, for filtering the converted information signal from a received signal,
- demodulator for demodulating an output signal of the filter,

- a signal decoder for performing a channel decoding operation at an output signal obtained from the demodulator, and
- a speech decoder for decompressing a speech signal obtained from the signal decoder and providing an output signal to a digital to analog converter which generates an analog output signal.

8. Mobile telephone comprising
- an analog to digital converter for converting an analog speech signal into a digital speech signal,
- a speech encoder for compressing the digital speech signal and providing the compressed signal,
- a signal encoder for performing a channel encoding operation at the compressed signal and providing a channel signal,
- a modulator for modulating the channel signal,
- a multirate filter according to one of the claims 1 to 5, for filtering the channel signal,
- a digital to analog converter, for converting the filtered channel signal into an analog signal,
- a transmitter to transmit the analog signal.

9. Method for designing a multirate filter as claimed in one of the claims 1 to 5, comprising the following steps:

a. decomposing a symmetrical filter H into its polyphase components $H_{R:1}$, ...,$H_{R:R-1}$,

b.1. identifying pairs of components $H_{R:r1}$ and $H_{R:r2}$ which are asymmetrical, which share a common input, and which are related to each other according to the relation $H_{R:r2} = \mathrm{M}_{\alpha,\psi}(H_{R:r1})$, wherein the parameters α,ψ can be different for each pair, and

b.2. replacing each such pair of components $H_{R:r1}$ and $H_{R:r2}$ by
- a first module with transfer function $H_0 = H_{R:r1} + H_{R:r2}$,
- a second module with transfer function $H_1 = H_{R:r1} - H_{R:r2}$, the first and the second module sharing the common input, and by
- a combination unit for generating a first and a second combination signal from the output signals of the first and the second module,

c.1. and/or identifying pairs of components $H_{R:r1}$ and $H_{R:r2}$ which are asymmetrical, which share a common output, and which are related to each other according to the relation $H_{R:r2} = \mathrm{M}_{\alpha,\psi}(H_{R:r1})$, wherein the parameters α,ψ can be different for each pair, and can be different from those identified in step b1,

c.2. replacing each such pair of components $H_{R:r1}$ and $H_{R:r2}$ by

- a first module with transfer function $H_0 = H_{R:r1} + H_{R:r2}$,
- a second module with transfer function $H_1 = H_{R:r1} - H_{R:r2}$, which

modules share the common output, and by

- a combination unit for generating a first combination signal from a first and a second intermediate signal, and providing said combination signal to the third module, and for generating a second combination signal from a first and a second intermediate signal, and providing said combination signal to the fourth module,

d.1. and/or identifying quadruplets of components which are asymmetrical and which comprise

- a first pair $H_{R:r1}$, $H_{R:r2}$ which are related by $H_{R:r2} = \mathrm{M}_{\alpha,\psi}(H_{R:r1})$
- a second pair $H_{R:r3}$, $H_{R:r4}$ which are related by $H_{R:r4} = \mathrm{M}_{\alpha,\psi}(H_{R:r3})$

wherein,

- the components $H_{R:r1}$ and $H_{R:r3}$ share a first common input,
- the components $H_{R:r2}$ and $H_{R:r4}$ share a second common input,
- the components $H_{R:r1}$ and $H_{R:r2}$ share a first common output, and
- the components $H_{R:r3}$ and $H_{R:r4}$ share a second common output,

d.2 and replacing said quadruplet by

a first module having transfer function

$H_0 = H_{R:r0} + H_{R:r1} + H_{R:r2} + H_{R:r3}$,

a second module having transfer function

$H_0 = H_{R:r0} - H_{R:r1} - H_{R:r2} + H_{R:r3}$,

a third module having transfer function

$H_0 = H_{R:r0} + H_{R:r1} - H_{R:r2} - H_{R:r3}$,

a fourth module having transfer function

$H_0 = H_{R:r0} - H_{R:r1} + H_{R:r2} - H_{R:r3}$,

a first combination unit for generating a first combination signal generated from input signals received at the first and the second common input, and providing said first

combination signal to the first and the second module, and for generating a second combination signal generated from those input signals, and providing said second combination signal to the third and the fourth module,

a second combination unit for generating a first auxiliary signal from output signals generated by the first and the third unit, and for generating a second auxiliary signal from output signals generated by the second and the fourth unit,

a third combination unit for generating a first and a second output signal from the first and the second auxiliary signal.